

REMARKS

In the Office Action mailed April 24, 2003:

Claims 9-15 were rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al. in view of Shishido et al.

Claim 20 was rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al. and Shishido et al. as applied to claim 1 (should be claim 9) above, and further in view of Hamzehdoost et al.

The rejections of claims 9-15 and 20 are respectfully traversed.

Claim 9 as previously amended recites a semiconductor chip carrier comprising a primary substrate, a metal heat sink plate having a coefficient of thermal expansion substantially different from that of the primary substrate, and a supplemental substrate constructed from a material having a substantially similar coefficient of thermal expansion as that of the primary substrate, wherein the supplemental substrate is attached to a first side of the metal heat sink plate and the primary substrate is attached to an opposing second side of the metal heat sink plate, and wherein the presence of the supplemental substrate prevents the semiconductor chip carrier from warping. The present invention utilizes the supplemental substrate, which has a substantially similar coefficient of thermal expansion as the primary substrate, to counter balance the bending force resulting from the mismatch of coefficients of thermal expansion between the primary substrate and the metal heat sink plate. Thus, this invention provides a solution to the chip-carrier warping problem where the coefficient of thermal expansion of the metal heat sink plate does not match that of the primary substrate.

Claim 9 is unobvious over Johnson and Shishido because these references, taken as a whole, do not teach or suggest the claimed subject matter. As shown in Fig. 6 of Johnson, which is reproduced on the following page, Johnson discloses an electronic circuit module comprising a substrate 12 upon which a chip 14 is mounted, and a heat spreader cap 22 mounted on an encapsulant 24 over the substrate 12 in order to dissipate heat and counter-balance the forces exerted by the thermal mismatch between the chip 14 and the substrate 12. To achieve the counter-balancing function, the heat spreader cap 22 in Johnson includes a midsection and a peripheral section and comprises two different materials 28 and 29, with

material 28 sitting between material 29 and the encapsulant 24 (Col. 3, lines 33-36, and lines 40-41; Col. 4, lines 7-12).

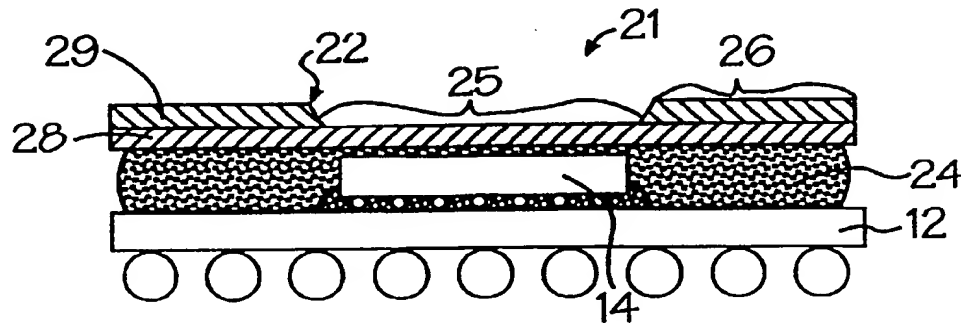
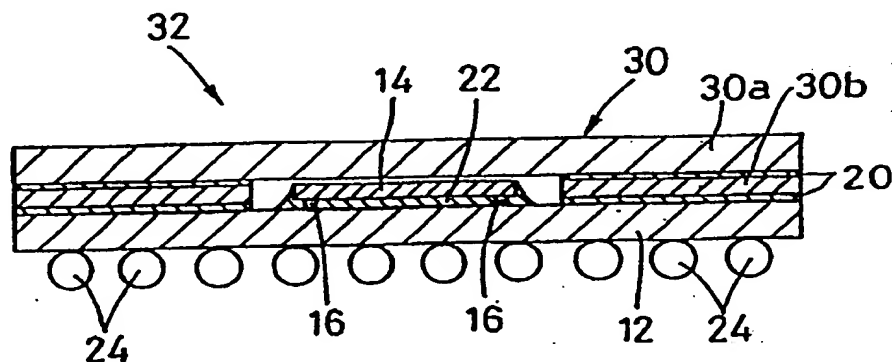


Figure 6

As shown in Fig. 2 of Shishido, which is reproduced below, Shishido discloses an electronic package comprising an organic substrate 12, a semiconductor chip 14 on a first surface of the organic substrate, and a thermally conductive structure 30a and 30b bonded to the substrate, wherein the thermally conductive structure is of a different material from the substrate while having substantially the same coefficient of thermal expansion as the substrate.

FIG. 2



The Examiner rejected claim 9 based on the argument that it is obvious to combine Johnson and Shishido by replacing part of Johnson's heat spreader cap 22, i.e., the upper material 29, with Shishido's conductive structure 30a that has substantially the same coefficient of thermal expansion as the substrate. This would result in a structure such as that in Figure 6 of Johnson (shown above) except that layer 28 of the heat spreader cap 22 would

have a coefficient of thermal expansion significantly different from that of the substrate 12 and that layer 29 of the heat spreader cap 22 would have a coefficient of thermal expansion substantially the same as that of the substrate 12.

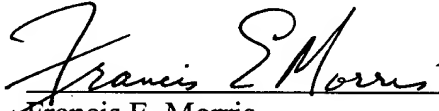
The Examiner's argument, however is one based on hindsight because the Examiner points to no teaching in either reference that suggests their combination. Moreover, there is no motivation for such a combination because the combination will not work. In Johnson, the two different materials 28 and 29 of the heat spreader cap 22 need to work together to counter-balance the forces exerted by the thermal mismatch between the chip 14 and the substrate 12 (Col. 3, lines 38-40 and lines 44-46). If material 29 is chosen to have the same coefficient of thermal expansion as the substrate 12 and material 28 continues to have a substantially different coefficient of thermal expansion from that of the substrate (as thought in Johnson and as recited in claim 9), then the heat spreader cap 22 comprising both materials 28 and 29 would have a substantially different coefficient of thermal expansion from that of the substrate 12; and the counter-balance function of the heat spreader cap 22 would be lost. Therefore, one skilled in the art would not be motivated to combine the structures of Johnson and Shishido, and Shishido cannot be properly combined with Johnson to reject claim 9. For these reasons, it is respectfully submitted that claim 9 is patentable over Johnson in view of Shishido.

Claims 10-15 and 20 depend from claim 9 and include further limitations in addition to the limitations in claim 9. Therefore, claims 10-15 and 20 are patentable for the same reason claim 9 is patentable. Further, claim 10 includes the limitation that the supplemental substrate is constructed from the same material as the primary substrate. This limitation is not found in either Johnson or Shishido. Johnson does not disclose that any of the materials in the heat spreader cap 22 be constructed from the same material as the substrate 12. Shishido explicitly states that the substrate 12 is made of an organic material (Col. 3, line 7) and the heat dissipating structure 30 is made of metal or metal alloy (Col.3, lines 32-42). Consequently, these structures are of different materials.

In view of the foregoing, applicants believe that all of the claims are now in condition for allowance and respectfully requests the Examiner to pass the subject application to issue. If for any reason the Examiner believes any of the claims are not in condition for allowance, he is encouraged to phone the undersigned at (650) 849-7777 so that any remaining issues may be resolved.

Respectfully submitted,

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